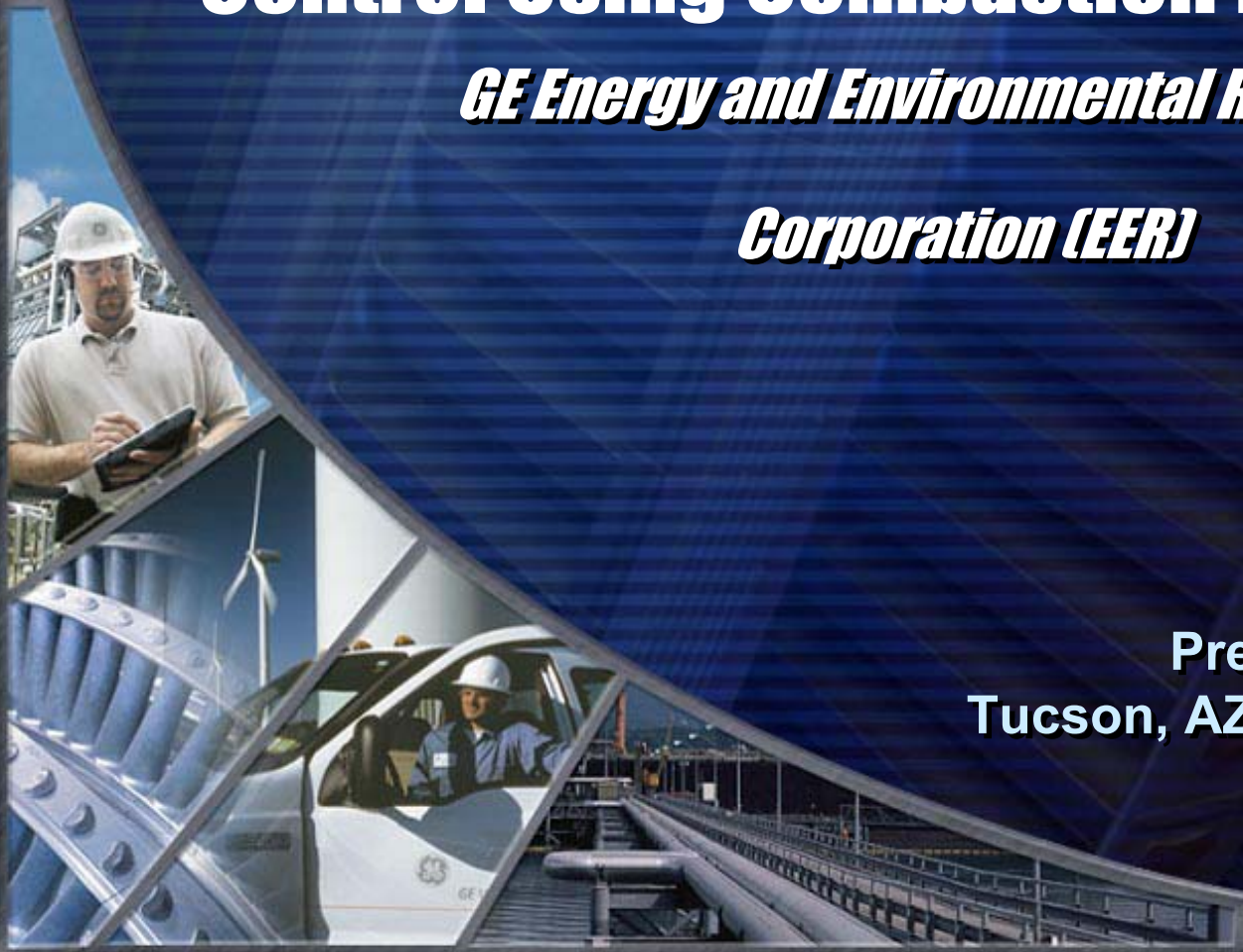
imagination at work

Preliminary Field Evaluation of Mercury Control Using Combustion Modifications

GE Energy and Environmental Research

Corporation (EER)

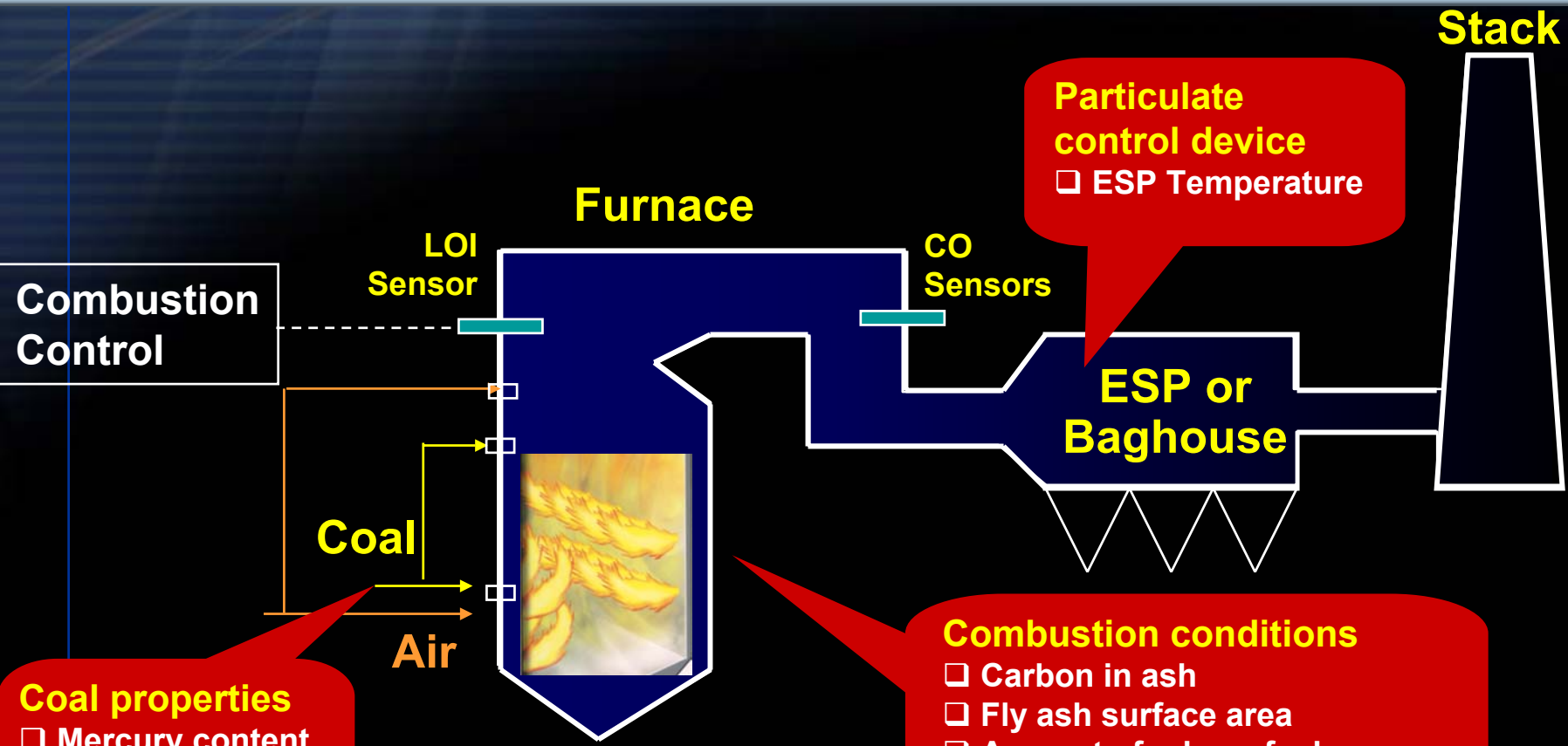


Presented to 2004 EUEC
Tucson, AZ, January 19-22, 2004

Presentation Outline

- Optimizing coal reburning for combined Hg and NO_x control
- Pilot-scale experimental facility
- Pilot-scale results
- Coal impacts
- Field data
- Summary

Coal Reburning for NO_x/Hg Control

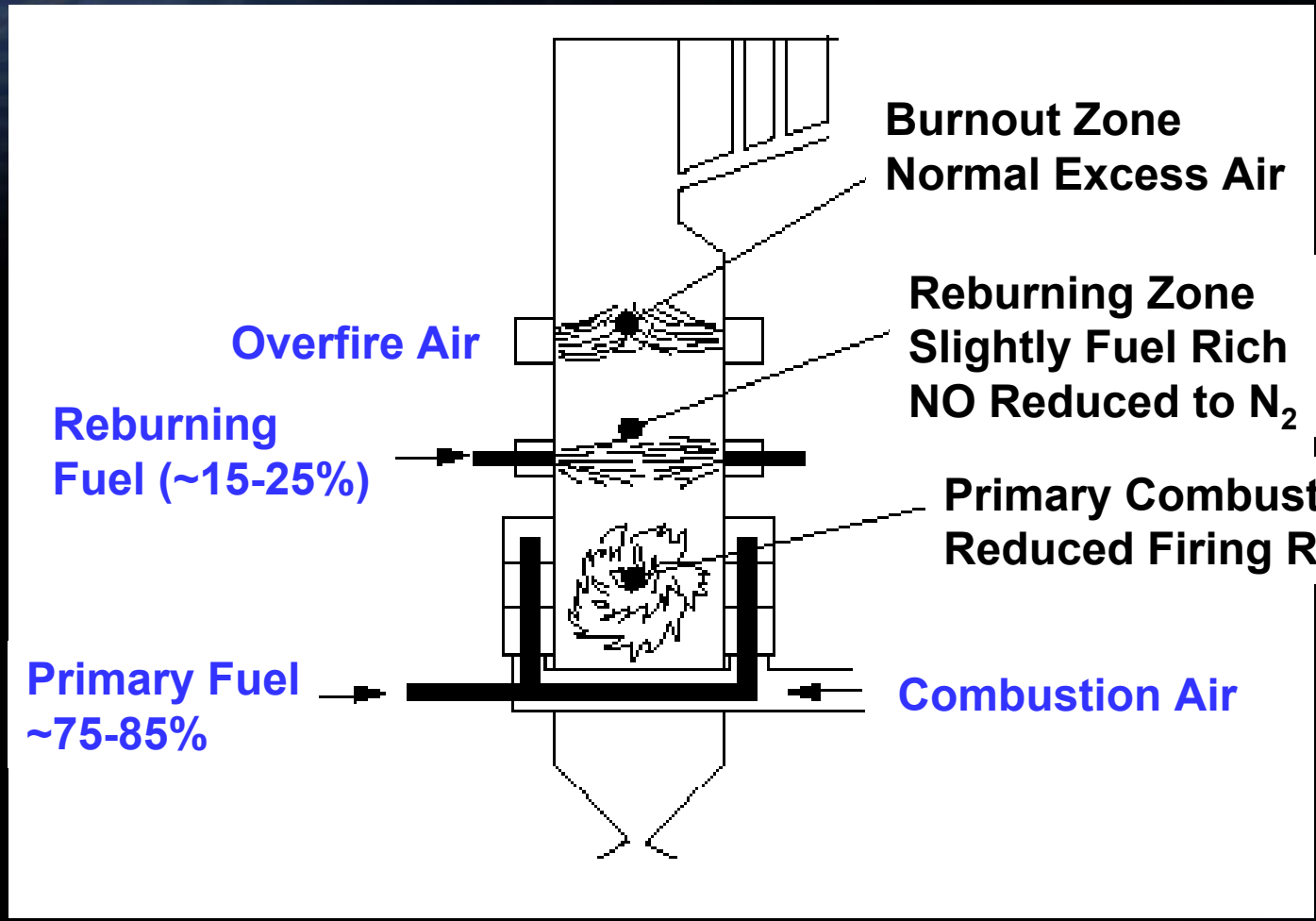


Optimizing Reburning for Combined Hg and NO_x Control

NO_x/Mercury Control at Green Station

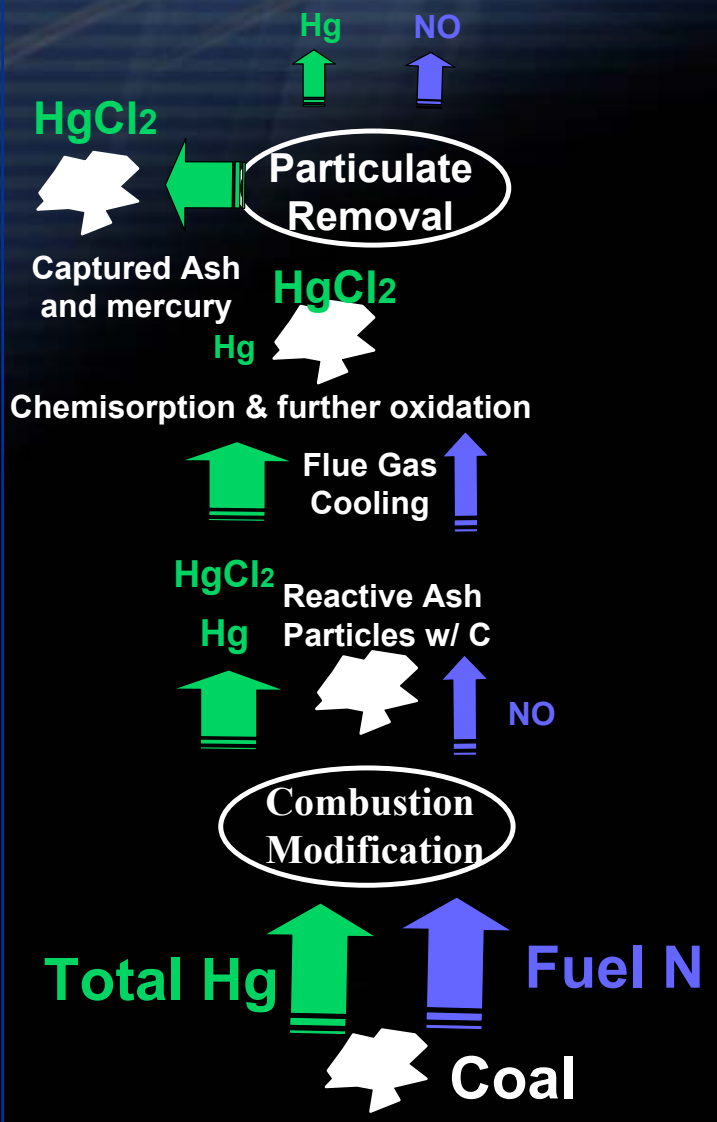
Objective:	Preliminary evaluation of Hg/NO_x control via coal reburning
Location:	Green Station Unit 2 near Henderson, Kentucky
Unit:	250 MW wall-fired
Equipment:	ESP and wet scrubber
Fuel:	blend of bituminous coal
Period:	January 2003 – July 2004

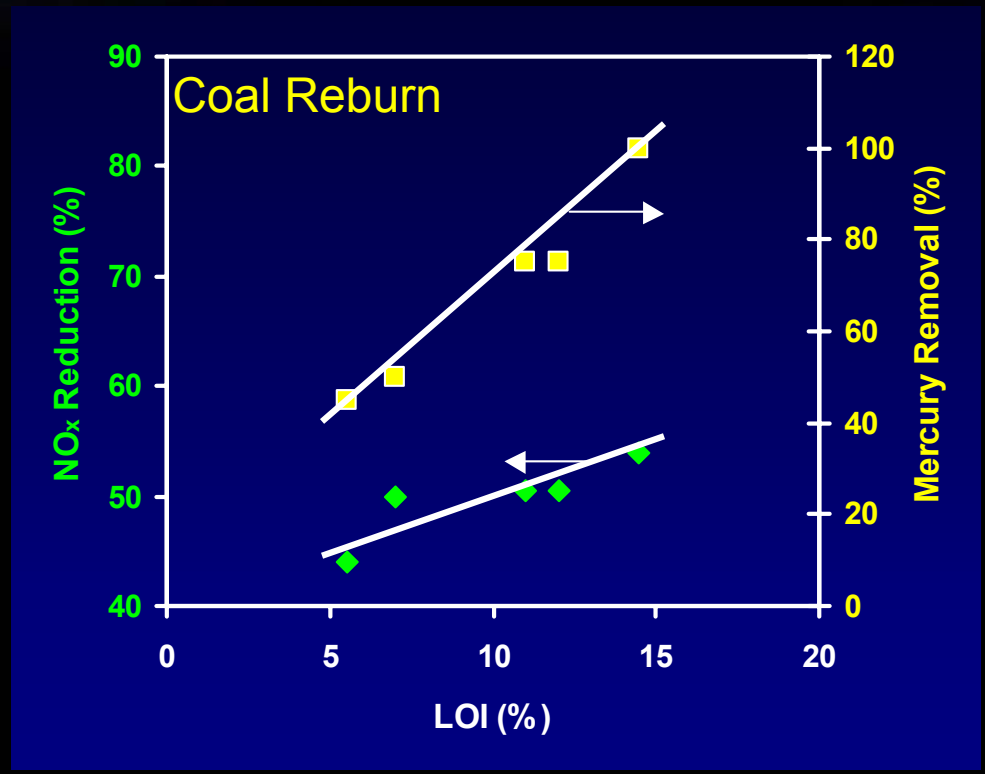
Application of Coal Reburn to Green Unit 2



The design of the reburning fuel and overfire air injectors must provide rapid mixing of the reburning fuel and the overfire air in order to maximize emissions control and to minimize unburned carbon and carbon dioxide emissions

Coal Reburn for NO_x and Mercury Control

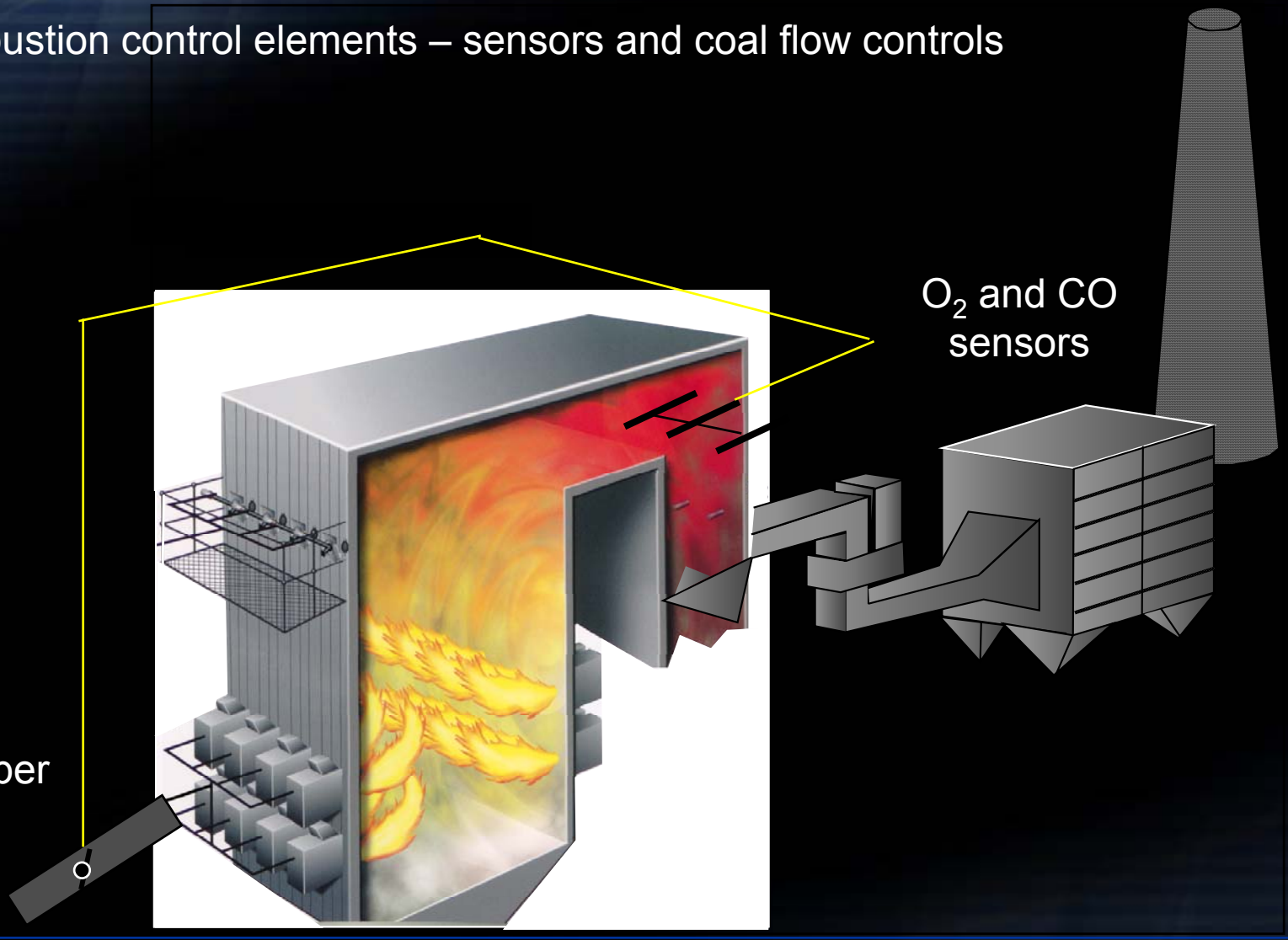




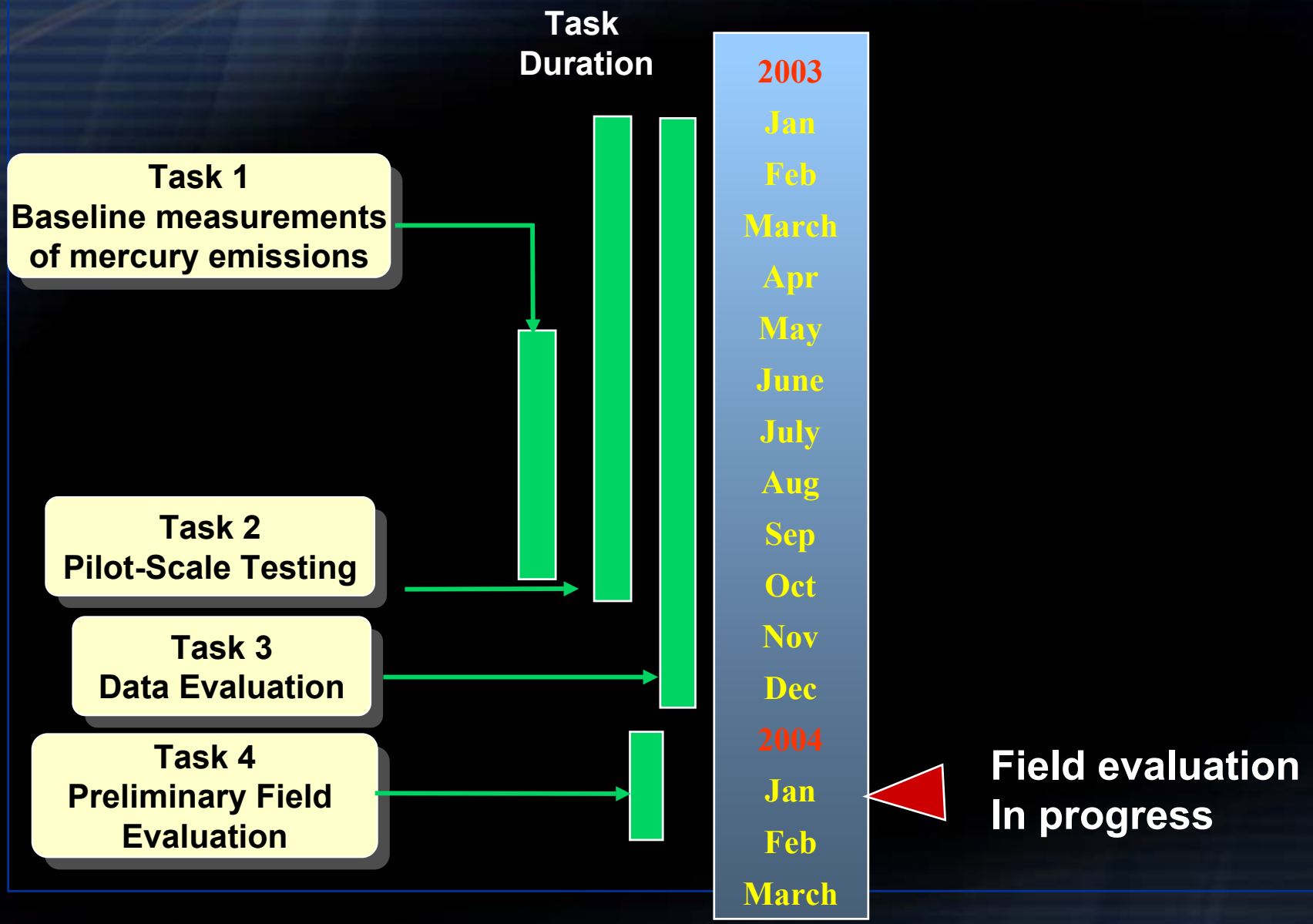
Combustion Optimization Improves Mercury and NO_x Control

Combustion Control In Unit 2

Combustion control elements – sensors and coal flow controls



Schedule of the Mercury Control Program

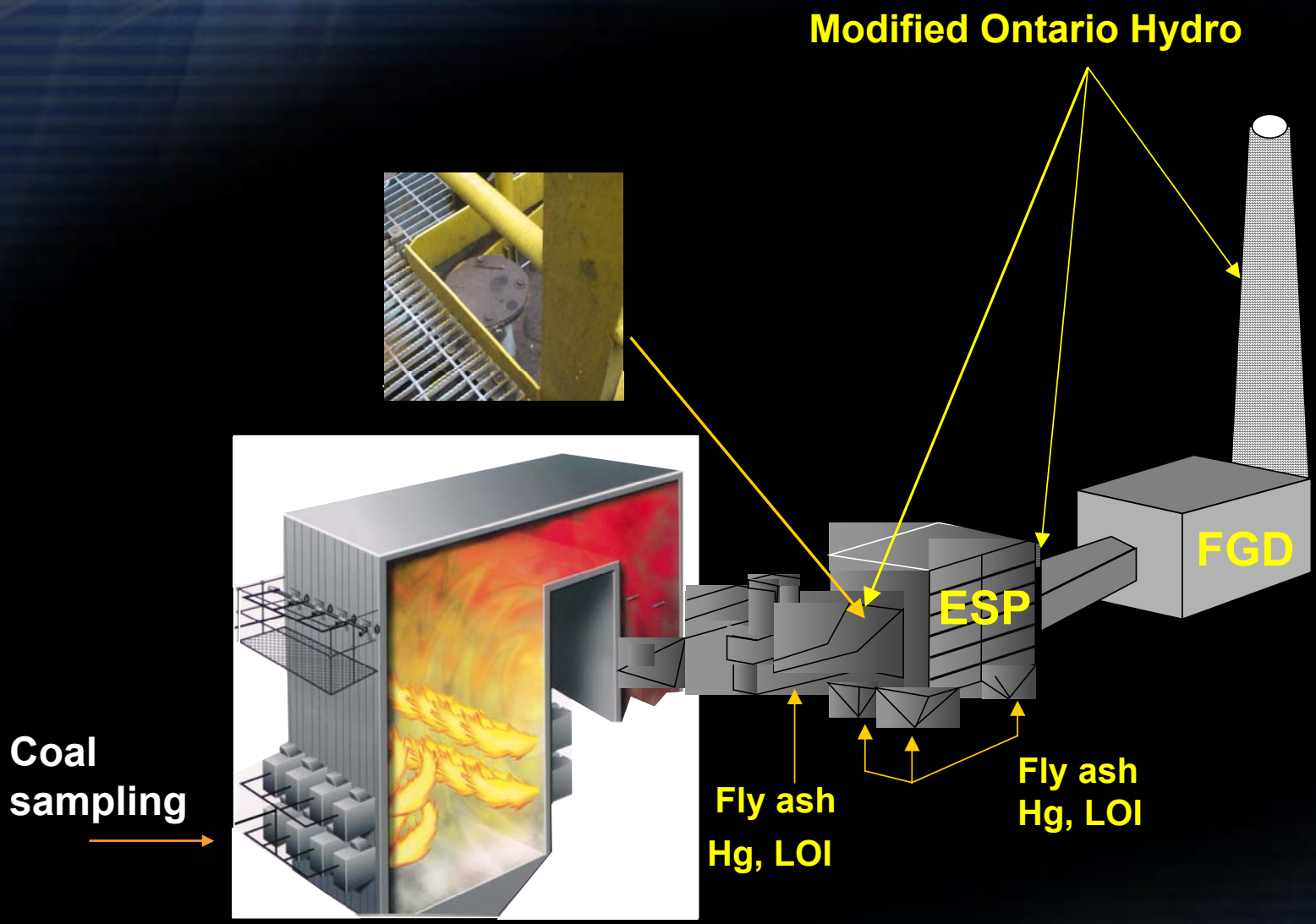


How Effective is Coal Reburn for Mercury Control?

Efficiency of Mercury Removal depends on:

- Coal type
- Coal composition (Cl, alkali, Ca, S, volatility, mineral matter)
- LOI
- Particulate control device (PCD)
- Temperature in PCD
- Combustion conditions
- SO_2 control equipment

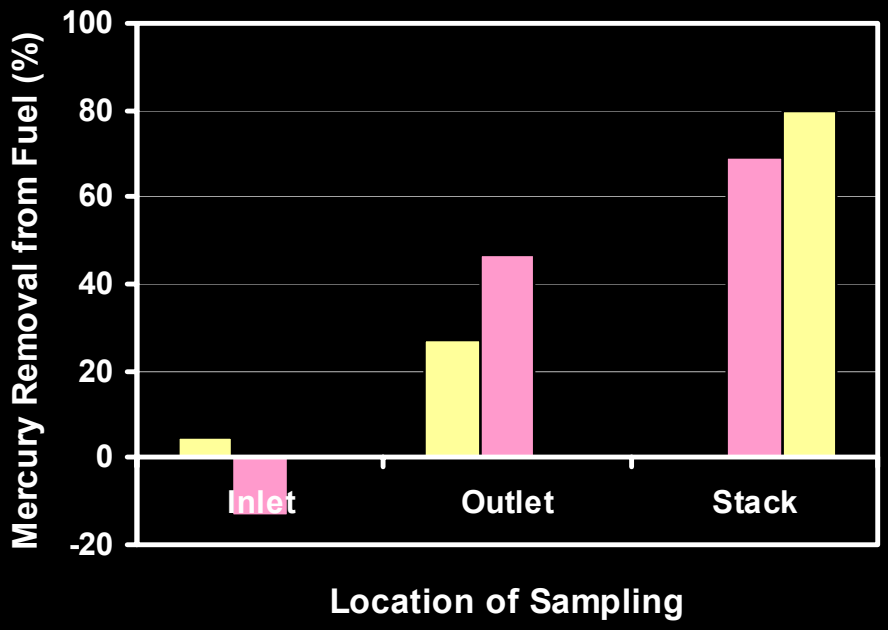
Baseline Mercury Testing in Unit 2

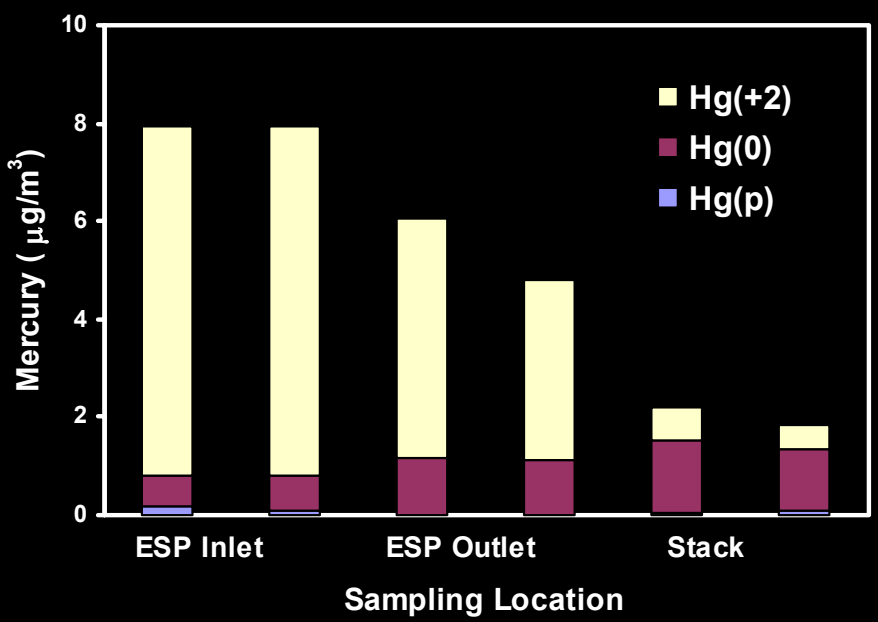


Mercury Emissions in Unit 2 without Reburn

Preliminary Data Analysis for Fuel #1

LOI = 9.5%





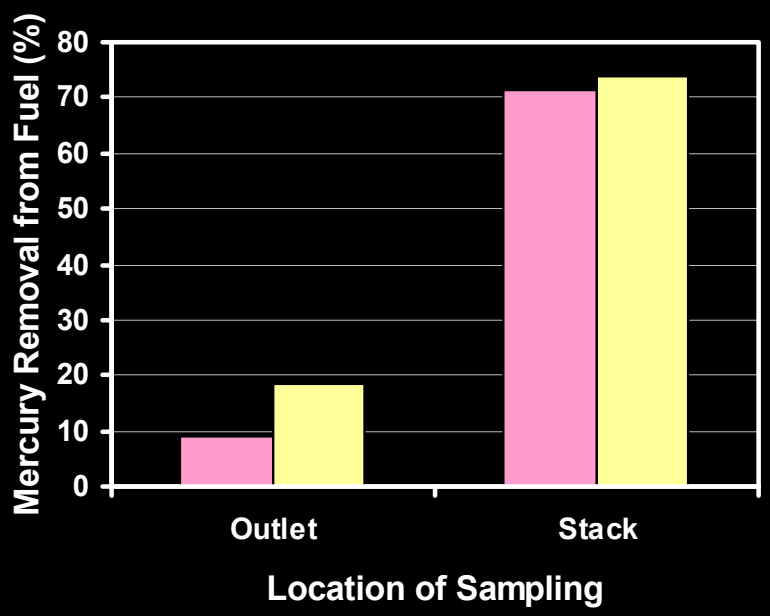
Mercury removal across wet scrubber: ~64%

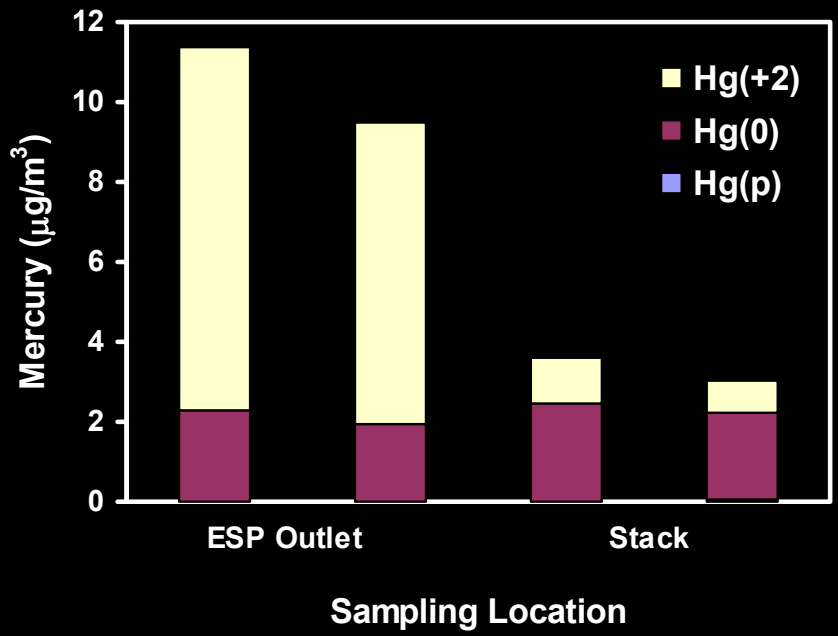
Oxidized:	**86% (80-90% in full-scale)**
Elemental:	**-20%**

Mercury Emissions in Unit 2 without Reburn

Preliminary Data Analysis for Fuel #2

LOI=2.5%





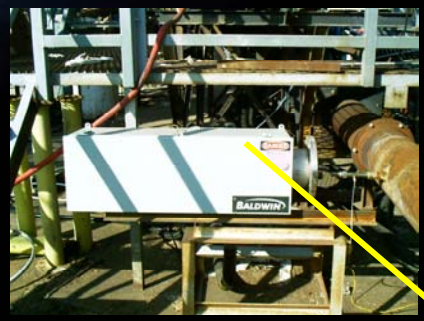
Mercury removal across wet scrubber: ~68%

Oxidized:	**88%**
Elemental:	**-8%**

Coal Mercury Evaluation in Pilot Scale

- One MMBtu/hr (300kW) Boiler Simulator Facility (BSF)
- Simulation of combustion conditions and time-temperature profile in a full-scale utility boiler
- Pilot-scale ESP and Fabric Filter
- Test variables include combustion conditions, coal type and coal blending

Sampling Probe



Analyzer

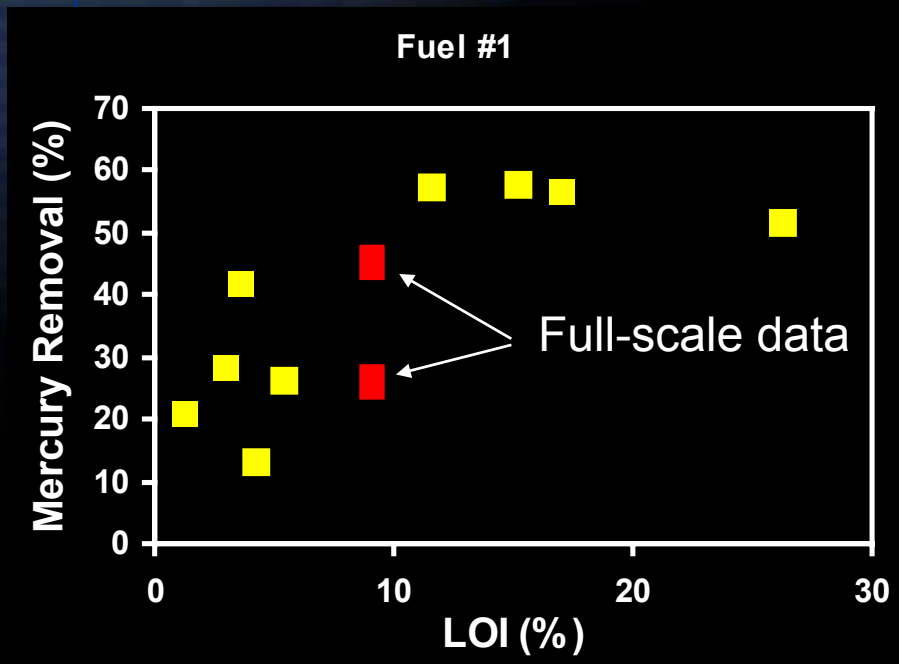
Speciation Modules

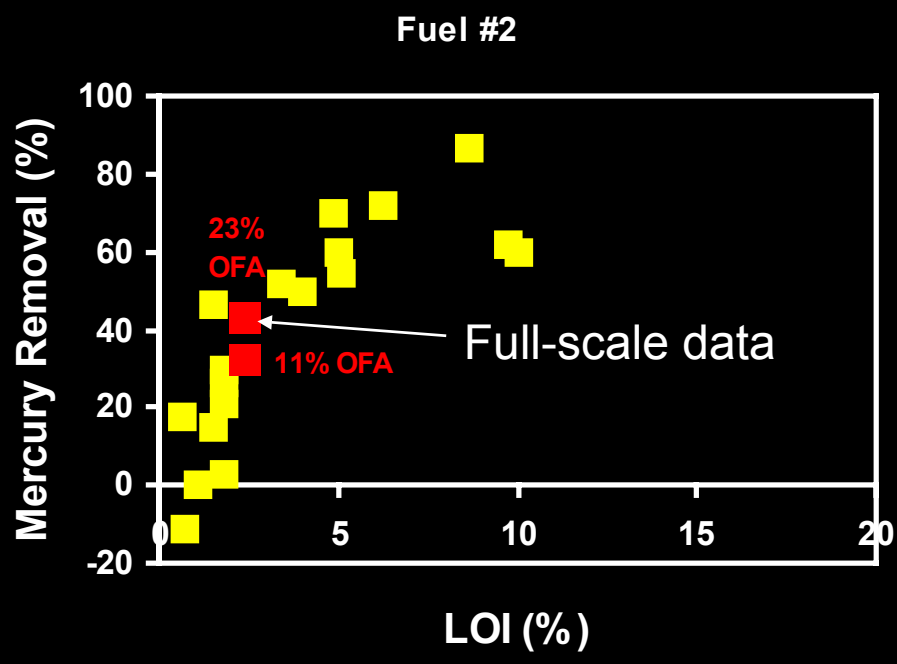
Mercury Analysis

- Online Hg analyzer from PS Analytical (The Sir Galahad II)
  - Atomic fluorescence
  - Wet chemical converter
  - Elemental and total mercury
  - Two channels (ESP inlet and outlet)
- Inertia probe for fly ash separation
- Manual methods
  - EPA method PRE-003 (Ontario Hydro)
  - EPA method 101A
- Mercury in coal and fly ash
  - Total concentration
  - Leachable (TCLP)

Pilot-Scale Data: Mercury Removal

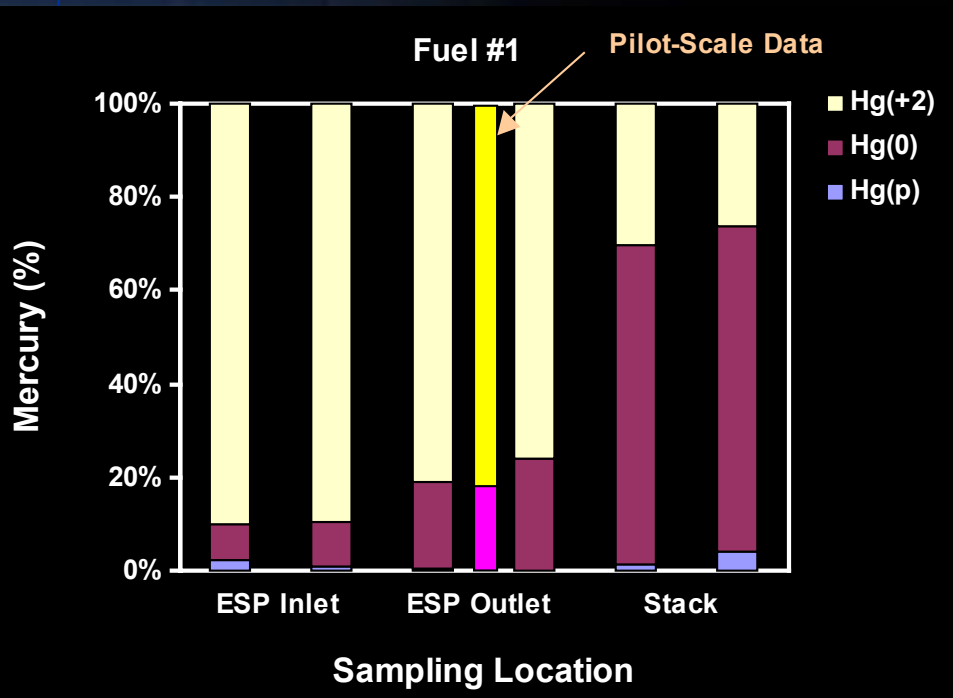
Mercury Removal Across ESP

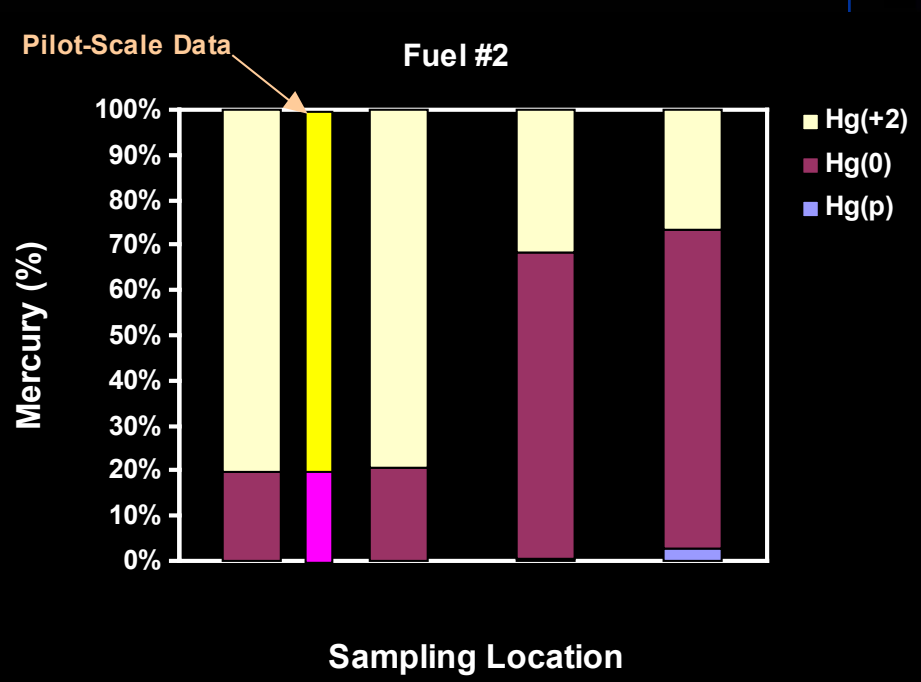




Pilot-Scale Data Agree with Full-Scale Measurements

Mercury Speciation

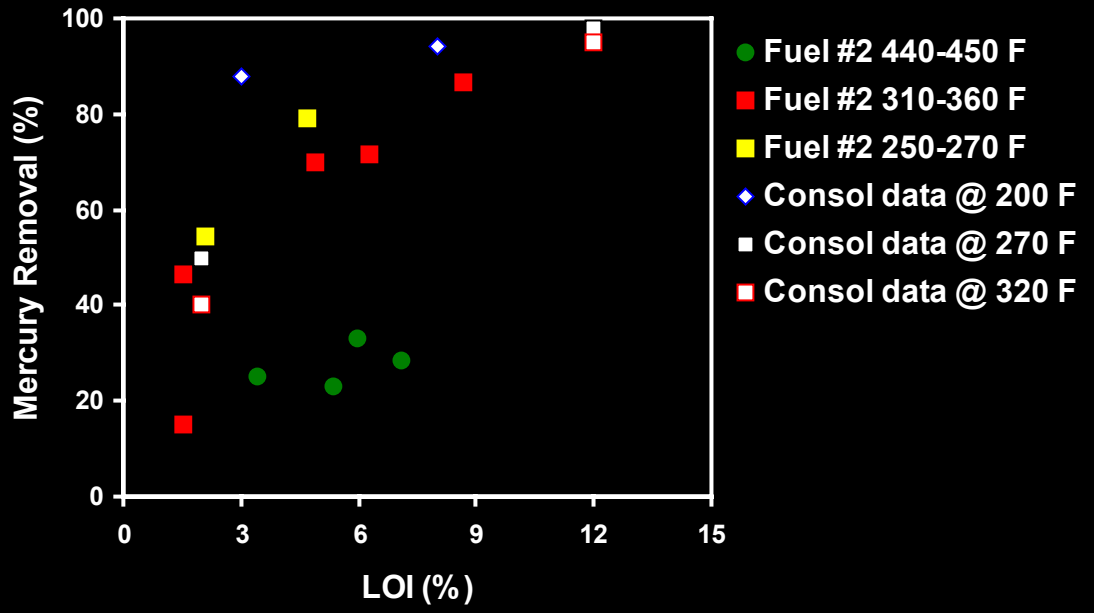




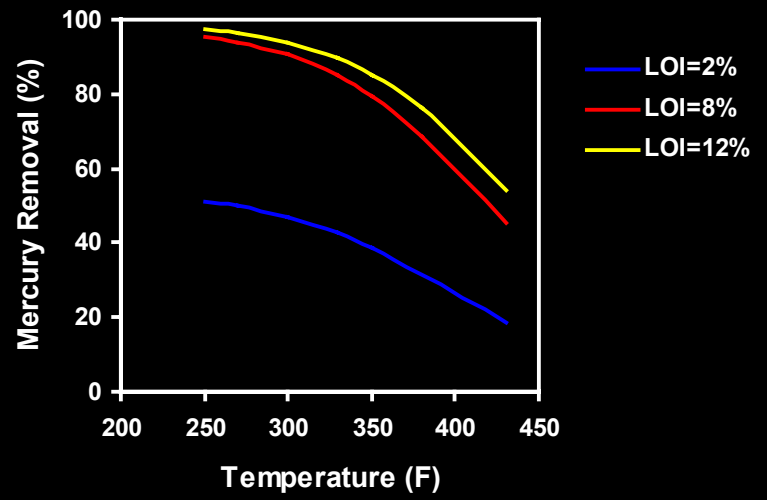
Pilot-Scale Data Agree with Full-Scale Measurements

Effect of ESP Temperature

Pilot-Scale Data



Projections



Decreasing ESP Temperature Can Improve Mercury Removal

Future Plans

- Reburning optimization tests in Unit 2 are scheduled for the week of January 19, 2004
- Maximum expected mercury removal efficiency
  - Fuel #1:
    - ✓ Across ESP - ~60% mercury removal from coal
    - ✓ Across ESP/scrubber – 85-90% mercury removal
    - ✓ LOI – 12-14%
  - Fuel #2
    - ✓ Across ESP – 80-85% mercury removal from coal
    - ✓ Across ESP/scrubber - ~90-95% mercury removal
    - ✓ LOI – 80-19%

Summary

- Full- and pilot-scale testing demonstrated that mercury removal efficiency depended on fuel properties
- 30-50% mercury removal across ESP and 70-80% removal across ESP/wet scrubber were observed in full-scale under air staging conditions
- Oxidized mercury was partially converted to elemental mercury in wet scrubber
- Pilot-scale data demonstrated that coal reburning and ESP temperature decrease can provide 90-95% mercury removal across ESP
- Reburning optimization testing is currently in progress

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